Model Improvement & Study Management Agency

Deputy Under Secretary of the Army (Operations Research)

ARMY STUDY HIGHLIGHTS

VOLUME XII

DECEMBER 1991

DEPARTMENT OF THE ARMY
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D.C. 20310-0102

23 December 1991

SFUS-MIS

MEMORANDUM FOR SEE DISTRIBUTION LIST

SUBJECT: Army Study Highlights

Once again, I am proud to acknowledge outstanding work of the Army's analysis community. Publication of *The Army Study Highlights* is a modest recognition of individuals and groups who have carried out fine analytical projects. This visibility provides an opportunity for others to take advantage of examples of good work. The studies chosen for this volume were professionally conducted and of significance to the Army's missions and goals. Selections were based on an evaluation of findings, assumptions, limitations, scope, objectives, and approach.

This twelfth volume presents eight quality studies. The volume also recognizes the recipients of the Dr. Wilbur B. Payne Memorial Award for Excellence in Analysis. Three awards were presented this year. The best group and individual authored papers in Army systems and operations analysis were honored. In addition, the Deputy Under Secretary of the Army (Operations Research) made a special award to a Concepts Analysis Agency team for its contribution to current operations during Operations DESERT SHIELD and DESERT STORM.

Thank you for your response to our call. The number and variety of nominations made for an exciting review. The examples of good analysis are very useful for the analysis community. I urge you to make the widest possible distribution of this publication in your organization.

Your suggestions are always welcome. Comments and requests for additional copies of the *Army Study Highlights* should be directed to Ms. Gloria Brown of this Agency, DSN 335-2952, Commercial 202/475-2952.

Eugene P. Visco

Eugene P. Visco, Director
US Army Model Improvement and
Study Management Agency
Office of the Deputy Under Secretary
of the Army (Operations Research)

SUBJECT: Army Study Highlights

DISTRIBUTION	COPIES
HQDA (ATTN: SAUS-OR)	1
HQDA (ATTN: SFUS-MIS)	6
HQDA (ATTN: SAMR)	2
HQDA (ATTN: SAIL)	2
HQDA (ATTN: SAIS)	2
HQDA (ATTN: DAMO-ZD)	5
HQDA (ATTN: DAPE-ZBR-R)	5
HQDA (ATTN: DALO-PLF)	5
HQDA (ATTN: DAMI-PBP)	2
HQDA (ATTN: DASG-HCD-D)	2
HQDA (ATTN: DACH-PPI)	2
HQDA (ATTN: DAJA-AL)	2
HQDA (ATTN: DAAR-OPL)	2
HQDA (ATTN: DAEN-ZCM)	2
HQDA (ATTN: DACS-DPD)	2
HQDA (ATTN: NGB-ARC-P)	2
OFFICE, SECRETARY OF THE ARMY (ATTN: MAIL AND RECORDS)	2
ARMY LIBRARY	5
COMMANDER-IN-CHIEF, US ARMY EUROPE AND SEVENTH ARMY (ATTN: AEAGX-OR)	10
COMMANDER:	
US ARMY TRAINING AND DOCTRINE COMMAND (ATTN: ATAN-SM)	10
US ARMY TRAINING AND DOCTRINE ANALYSIS COMMAND (ATTN: ATRC-ZD)	20
US ARMY FORCES COMMAND (ATTN: AFCO-MD)	20
US ARMY MATERIEL COMMAND (ATTN: AMC-AQ-PM)	20
US ARMY MILITARY TRAFFIC MANAGEMENT COMMAND (ATTN: MT-PLO)	2
US ARMY CRIMINAL INVESTIGATION COMMAND (ATTN: CIAC-MS)	2
US ARMY MILITARY DISTRICT OF WASHINGTON (ATTN: ANRM-RE)	2
US ARMY HEALTH SERVICES COMMAND (ATTN: HSHN-M)	5
US ARMY INTELLIGENCE AND SECURITY COMMAND (ATTN: IAFI-CP-C)	2
US ARMY MILITARY ENTRANCE PROCESSING COMMAND (ATTN: MEPCT-P)	2
US ARMY RECRUITING COMMAND (ATTN: USARCPAC-RE)	2
US ARMY OPERATIONAL TEST AND EVALUATION COMMAND (ATTN: CSTE-ZS)	5

SUBJECT: Army Study Highlights

DISTRIBUTION:	COPIES
US ARMY INFORMATION SYSTEMS COMMAND (ATTN: AS-OC-MP)	2
EIGHTH US ARMY	10
US ARMY STRATEGIC DEFENSE COMMAND (ATTN: DACS-BMP)	2
US ARMY LOGISTICS MANAGEMENT CENTER (ATTN: DLSIE)	5
SUPERINTENDENT, UNITED STATES MILITARY ACADEMY (ATTN: MACO-M)	5
COMMANDER/DIRECTOR US ARMY ENGINEER STUDY CENTER (ATTN: CEECS)	5
DIRECTOR:	
US ARMY CONCEPTS ANALYSIS AGENCY (ATTN: CSCA-MSM-C, CSCA-RQ, CSCA-RA, CSCS-FS)	20
US ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY (ATTN: AMXSY-D)	10
ARROYO CENTER	5
STRATEGIC STUDIES INSTITUTE (ATTN: AWCI)	2
DEFENSE NUCLEAR AGENCY (ATTN: LASS)	2
COMMANDANT:	
US ARMY WAR COLLEGE (ATTN: LIBRARY)	5
NATIONAL DEFENSE UNIVERSITY (ATTN: LIBRARY)	10
US ARMY COMMAND AND GENERAL STAFF COLLEGE (ATTN: LIBRARY)	5
US NAVY WAR COLLEGE (ATTN: LIBRARY)	5
US AIR WAR COLLEGE (ATTN: LIBRARY)	5
CHIEF OF NAVAL OPERATIONS (ATTN: OP966)	2
HEADQUARTERS, US MARINE CORPS (ATTN: RDS-40)	2
OFFICE, JOINT CHIEFS OF STAFF (ATTN: J-8)	2
DEFENSE TECHNICAL INFORMATION CENTER (ATTN: DTIC-DDA)	2

MODEL IMPROVEMENT & STUDY MANAGEMENT AGENCY

TABLE OF CONTENTS

STUDY GISTS

Engineer Studies Center	AIRLAND BATTLE SURVIVABILITY AND CAMOUFLAGE PHASE 1: An Assessment of the U.S. Army Camouflage Program	STUDY GIST CEESC-R-91-2

PRINCIPAL FINDINGS:

(1) The Army's present approach to camouflage fails to adequately define and integrate the role of camouflage within an umbrella counter-reconnaissance, surveillance, and target acquisition (RSTA) concept.

(2) There are presently more agencies, players, and programs involved in camouflage, concealment and deception (CCD)/counter-RSTA than can be effectively coordinated and integrated under existing staff proponency and integrating center assignments.

(3) There are major camouflage program deficiencies within each of the TRADOC combat developments domains of doctrine, training, leader development, organizations, and materiel.

(4) The present TRADOC separation of responsibilities for camouflage and deception appears unsound and warrants further analysis.

(5) Emerging AirLand Battle-Future doctrine reflects a continued underestimation and dangerous simplification of the RSTA threat. Doctrine so developed risks catastrophic failure in its wartime application.

(6) The Army's camouflage materiel readiness is questionable.

(7) A counter-RSTA tactical decision aid should be developed to assist commanders in battlefield CCD planning.

(8) The CCD contribution to battle outcomes must be better reflected in combat simulations.

MAIN ASSUMPTIONS:

(1) Technology advances will continue which will increase the speed and ease of target detection and acquisition; the capabilities of these means to penetrate or neutralize present countering systems will be continually enhanced.

(2) Threat and ALB/ALB-F doctrine will continue to emphasize high-tempo operations, which impacts on time available to accomplish CCD tasks.

(3) Potential enemy capabilities in camouflage and camouflage counters will range from low-to high-technology, simple to sophisticated; these capabilities may be encountered simultaneously in varying mixes.

(4) Resources for all Army programs will become more constrained. Resources allocated for CCD purposes will be at the expense of other competing needs and programs.

PRINCIPAL LIMITATIONS: The study relies primarily on published reports and interviews. Field evaluations were not performed.

SCOPE OF THE STUDY:

(1) Identifies the CCD arena with regard to players and programs; examines proponency issues regarding the division of responsibilities for camouflage and deception; addresses deception to the extent that it overlaps and is otherwise intrinsic to camouflage measures.

(2) Assesses the Threat-imposed requirements for a camouflage program (the RSTA threat).

(3) Assesses the U.S. Army's camouflage program versus the RSTA threat; examines the adequacy of present doctrine, training, leader development, organizations, and materiel developments and readiness.

(4) Briefly examines foreign camouflage programs for comparison purposes with the U.S. Army CCD program.

(5) Illuminates CCD implications inherent in the Army's emerging AirLand Battle-Future doctrine.

(6) Examines the ability of models and combat simulations to measure the contribution of camouflage to battlefield outcomes and to measure the effectiveness of RSTA countermeasures.

STUDY OBJECTIVE: The study will provide an independent evaluation of the U.S. Army's overall camouflage program and provide recommendations for future direction.

BASIC APPROACH: This study is being done in two phases. Phase 1 assessed the U.S. Army's current camouflage program by examining published CCD research, intelligence reports, U.S. and foreign doctrinal literature, and Army lessons learned data. Interviews with CCD specialists and doctrinal proponents provided additional information. The Phase 2 study effort will focus on developing a recommended organizational approach to resolve current and projected CCD program deficiencies and ensure an integrated CCD program. Phase 2 will also address the integration of CCD into combat simulations which will realistically include and measure the CCD contribution to battle outcomes.

REASONS FOR PERFORMING THE STUDY: The impetus for this study was the U.S. Army Engineer School's assumption of proponency for camouflage from the Combined Arms Center (CAC) in October 1987. Initial assessments conducted by the Engineer School showed a fragmented and disjointed CCD program. The Engineer School saw the necessity for a comprehensive assessment of the Threat-imposed need for camouflage, how well the current camouflage program meets this need, and what needs to be done. The Engineer School Commandant, MG Daniel R. Schroeder, requested that the Engineer Studies Center (ESC) perform this study in two phases.

STUDY SPONSOR: The sponsor of the study is the U.S. Army Engineer School.

PERFORMING ORGANIZATION AND PRINCIPAL AUTHORS: The Phase 1 study effort was performed by ESC under the direction of Dr. Lawrence Lang. The Phase 2 study effort continues under the direction of Mr. Lawrence Wright. The principal authors for the Phase 1 report are Mr. William Florence and Mr. Fredrik Wiant.

DTIC ACCESSION NUMBER OF FINAL REPORT: DA 314237

COMMENTS AND SUGGESTIONS MAY BE SENT TO: Cdr/Dir, U.S. Army Engineer Studies Center, Casey Building #2594, Ft Belvoir, VA 22060-5583.

START AND COMPLETION DATES OF STUDY: Starting Date: September, 1989
Completion Dates
Phase 1: September, 1990
Phase 2: October, 1991

AN EVALUATION OF THE VISION EXECUTION SYSTEM DEMONSTRATION PROTOTYPES

REASONS FOR PERFORMING THE STUDY

The VISION Execution System, called the Readiness-based Maintenance System (RBMS) concept by the Army, was conceived to help the Army adapt to a radically changing world. Although the final shape of that future world still cannot be definitively described, it is more likely to be characterized by uncertainty in the threat, the importance of short-term contingencies that require rapid responsiveness, a reliance on high-technology weapons as combat multipliers, and a shrunken resource base.

The new environment poses the greatest challenge for restructuring and rethinking the Army has faced in decades. Of paramount importance will be the concept of weapon system management. The Army Material Command (AMC) is developing the means to transform its management to a weapon system orientation. As the Army begins to build new structures, it also must devise management systems such as RBMS that will help these organizations function effectively.

THE STUDY OBJECTIVES

1. To develop a demonstration prototype of RBMS and operate it at RAND with Army participation.

2. To evaluate the value of RBMS in terms of three criteria:

- Feasibility—can data systems be designed or altered to feed RBMS?
- Effectiveness—will RBMS increase combat power at acceptable cost?
- Usability—can existing logistical organizations be changed to exploit RBMS capabilities?

STUDY SCOPE

1. The concept discussed here is part of a series of concepts for logistics decision support systems aimed at improving wartime and peacetime availability of important U.S. Army weapon systems through improved management of Class IX (reparable) items.

THE BASIC APPROACH

1. The plan for testing the RBMS concept involves using an incremental approach to prototyping, working through two phases of prototyping: one for demonstration purposes and one for a hands-on operational version to be exercised by Army personnel.

2. The demonstration prototypes feature high-cost, high-technology components because:

- These items are more likely to use the complex, multi-echelon support structures RBMS was designed to address;
- Their cost and combat criticality make them leading candidates for inclusion in asset tracking systems RBMS exploits;
- Their low cube/weight factors encourage consideration of expedited shipping and handling;
- These items are often share common test, measurement, and diagnostic equipment (TMDE).

3. Three separate demonstration prototypes were chosen to examine the application of RBMS to different echelons:

- Division level—the repair capability of the Direct Support Electrical System Test Set (DSESTS) used for fault diagnosis of fire control and turret components of the M1 Abrams tank and M2/3 Bradley fighting vehicle;
- Theater level—the special repair activity (SRA) dedicated to support the Target Acquisition Designation Sight/Pilot Night Vision Sensor (TADS/PNVS) of the AH-64 Apache;
- Depot level—the workload of the electro-optical shop at the Sacramento Army Depot, which fixes mostly night vision components on a wide range of weapon systems.

THE PRINCIPAL FINDINGS

1. The demonstration prototype allowed the RBMS to be developed and exercised through theoretical analyses in a laboratory-style environment. These analyses helped pinpoint the value of RBMS with regard to its feasibility, effectiveness, and usability.

2. Feasibility implies the methodological suitability of the underlying Distribution and Repair In Variable Environments (DRIVE) algorithm, which interprets an input database and determines a priority sequence of repair and distribution actions across a planning horizon. The demonstration prototypes revealed that although DRIVE has its shortcomings, further enhancement of it should make it highly suitable to RBMS.

3. Another part of feasibility is data quality and availability, because RMBS relies on operational data about units and logistics data for weapon system components. Analysis revealed that operational data are often not collected or, at best, are difficult to obtain, while logistics data, though currently available from standard Army management information systems (STAMIS), may require processing into a suitable format.

4. Although RBMS is designed by be most effective when it receives accurate information, relative rates of activity among units can be used in place of precise figures or estimates.

5. The prototype evaluations also revealed the effectiveness of RBMS over the current system in increasing weapon system availabilities. In addition, RBMS apparently provides more flexible and responsive support at a lower cost than the current system.

6. Usability concerns the interaction between the user and the system, with particular regard to the policy and procedural implications of implementing RBMS in the real world. Interviews and demonstrations conducted with potential users indicated they were favorably impressed with the RBMS concept. Users raised concerns about how the current way of doing business would have to change if RBMS were implemented. Issues ranging from changes in performance measures to ensuring the availability of bit-and-piece parts for repair should be thought through very carefully before RBMS is implemented.

THE MAIN ASSUMPTIONS

1. The recent changes in the world situation portend a vastly different and uncertain threat the Army must be able to face.

2. The Army is likely to be based in the continental United States, which puts pressure on the support system to be rapidly responsive.

3. The reliance on high-technology weapon systems will come at the cost of easy or cheap supportability.

4. The Army must accomplish its missions with fewer resources than it is accustomed to having.

5. The new environment poses the greatest challenge for restructuring and rethinking that the Army has faced in decades.

THE PRINCIPAL LIMITATIONS

1. The quality of the data used in the analyses is sometimes suspect.

2. Only the major assemblies of high-technology reparable parts within a represented weapon system were studied.

STUDY IMPACT

1. Based on these evaluations, the Army has adopted the concepts of RBMS as one of the key initiatives being developed by the Strategic Logistics Agency (SLA).

2. RBMS has been funded for development as part of the SLA modernization program.

STUDY SPONSOR

The study is jointly sponsored by the Assistant Deputy for Materiel Readiness, AMC; the Commanding General, CASCOM; and the Director of the SLA.

PERFORMING ORGANIZATION AND PRINCIPAL AUTHORS

The Arroyo Center
RAND
1700 Main Street
P.O. Box 2138
Santa Monica, CA 90407-2138
(213) 393-0411

Principal Authors: Patricia M. Boren, Karen E. Isaacson, Judith E. Payne, Marc L. Robbins, and Robert S. Tripp.

DTIC ACCESSION NUMBER OF FINAL REPORT

Presently not available.

COMMENTS AND QUESTIONS MAY BE SENT TO

Robert S. Tripp
RAND
1700 Main Street
P.O. Box 2138
Santa Monica, CA 90407-2138

START AND COMPLETION DATE OF THE STUDY

Fall 1989–Fall 1990

ARMS CONTROL REGIMES AND BALLISTIC MISSILE DEFENSE

REASONS FOR PERFORMING THE STUDY

The outlook for a continued warming in the U.S.–Soviet relationship and the ever-growing threat and reality of missiles in the third world suggest both the opportunity and the need for effective nationwide defenses against ballistic missile attack. Until now, this focus has been on developing ballistic missile defenses (BMD) against a deliberate, large, and unconstrained Soviet attack. These defenses were intended for competitive deployment outside the framework of arms control and outside the 1972 ABM Treaty and 1974 Protocol. A refocused SDI might instead emphasize BMD against accidental, unauthorized, and/or Nth-country attack, in anticipation of a cooperative deployment within a framework of bilateral, or possibly multilateral, arms control agreements.

THE STUDY OBJECTIVES

1. To carry out a top-down assessment of arms control agendas that includes substantial roles for BMD, with particular emphasis on the architectures required to support an effective *thin area defense* of the U.S. national territory.

- By "thin," we mean a defense whose capabilities are limited to protecting against the smaller-size attacks that would most likely characterize the threat under consideration, and a defense that does not significantly undermine current offense-dominant postures.
- By an "area defense," we mean one whose components are not earmarked for the protection of specific targets, but rather provide defense coverage for large numbers of possible targets over wide regions.

STUDY SCOPE

Because of the rapidly changing world situation and the fact that candidate weapon and sensor systems are in a continuing state of conceptual evolution, the study adopted a generic approach to characterizing and modeling both the offense and the defense. The goal was to provide fundamental insights into a broad range of issues associated with thin area defense: the trade-offs in performance among alternative weapon and sensor constructs; the sensitivity of this performance to variations in threat and defense characteristics; the impact of U.S.–Soviet asymmetries on their relative requirements for effective defense; and the directions that technology should be pushed to provide the most effective weapon and sensor support for the limited defense mission.

THE BASIC APPROACH

1. The project identified five basic arms control/BMD agendas—BMD constrained by current ABM Treaty; hard-point BMD; thin area BMD; "balanced" ballistic missile offense/defense; and defense dominance—and rated them by how much they further fundamental national security objectives.

2. Of the three preferred agendas—hard-point BMD, thin area BMD, and defense dominance—the study focused on cooperative deployment of thin area defenses as a distinct near-term possibility.

3. Various BMD architectures were analyzed and compared by postulating a baseline threat that includes launches of between one and 20 missiles (up to 200 reentry vehicles (RVs)) from superpower ICBM and normal-patrol sea-launched ballistic missile (SLBM) locations, close-in (1500-km) SLBM positions, and representative Nth-country sites.

4. Attack on, and defense of, both the United States and the Soviet Union was analyzed.

5. For the thin area ballistic defense mission, performance trade-offs were examined between two generic, near-term, kinetic-energy architectures:

- A system of ground-based interceptors (GBIs), with sensor support from ground-based radars, pop-up long-wave, infrared (LWIR) probes, or a network of space sensors that track boosters and RVs continuously from the moment they clear cloud cover;
- A system of autonomous space-based interceptors ("brilliant pebbles").

THE PRINCIPAL FINDINGS

1. Six GBI sites (four on the U.S. mainland, one in Alaska, and one in Hawaii) are sufficient to provide U.S. footprint coverage against single-object launches from beyond 1500 km of the U.S. coast. Deployments of 400/850/1850 GBIs provide a high probability of negating attacks of 50/100/200 RVs vehicles targeted randomly against the national territory from greater than 1500 km offshore or U.S. population centers from greater than 3000 km offshore.

2. Relative to ground-based radars, pop-up LWIR probes, as currently envisioned, were found to significantly enhance GBI performance against long-range threats, but not against shorter-range threats. However, space-based tracking sensors can greatly enhance GBI performance against all threat categories.

3. The short-range SLBM threat against U.S. territory cannot be effectively countered by a thin deployment of ground-based interceptors.

4. U.S.–Soviet asymmetries will be central to any future negotiations on the cooperative establishment of thin area defenses. Although the Soviet land mass (subject now to breakup) is 2.4 times that of the United States, the study found that

Soviet GBI requirements relative to U.S. requirements are far less than the suggested difference in area—circumference rather than area matters most. Moreover, because of striking differences in population distribution, the number of GBIs required to defend the Soviet population is not discernibly different from that required to defend U.S. population centers.

5. Although not viable as a stand-alone system for defending the United States against a regiment/boatload-sized launch of as many as 200 RVs, "brilliant pebbles" could significantly contribute as the space-based component of a layered architecture in which a ground-based GBI underlay could address RVs that leak through the pebble defense.

ASSUMPTIONS AND LIMITATIONS

1. The study was limited to investigating BMD deployment options against limited-size threats and within a U.S.–Soviet cooperative framework. In particular, the analysis assumed that offensive countermeasures (e.g., warhead decoys) would be substantially constrained in the near term by arms control agreements in the case of superpower ballistic missiles launched by accident or without authorization and by technological limitations in the case of Nth-country attacks.

STUDY IMPACT

Through a series of briefings to members of Congress, Army officers, and SDIO leadership, this study has fundamentally contributed to the overall understanding of the U.S. thin area defense mission, the deployments required to satisfy the mission, and what to expect from the Soviet Union in future negotiating sessions.

STUDY SPONSOR

The study is sponsored by the Commander, U. S. Army Strategic Defense Command.

PERFORMING ORGANIZATION AND PRINCIPAL AUTHORS

The Arroyo Center
RAND
1700 Main Street
P.O. Box 2138
Santa Monica, CA 90407-2138
(213) 393-0411

Principal Authors: Michael Miller, Howard Weisberg, William Harris, and Susan Everingham.

DTIC ACCESSION NUMBER OF FINAL REPORT

Presently not available.

COMMENTS AND QUESTIONS MAY BE SENT TO

Michael Miller
RAND
1700 Main Street
P.O. Box 2138
Santa Monica, CA 90407-2138

START AND COMPLETION DATE OF THE STUDY

Fall of 1989–Spring 1991

Principal Findings

1. The problems created by drug abuse and drug trafficking are enormous--far greater than is generally believed. American social structures, public health and moral standards are being degraded while the economic loss approaches $200 Billion annually.

2. The drug war is winnable but the United States is not yet winning.

3. While the decisive solution is demand reduction, attacking the drug suppliers and their distribution system will continue as an imperative.

4. Although the national counterdrug strategy is viable and tactical actions by drug law enforcement agencies are commendable, no adequate system exists for translating the strategy into sustained operations supported by plans, programs and budgets. There is a planning void at the operational level.

5. Interagency cooperation and joint operations are quite feasible at the tactical level. The challenge is to achieve the harmony at the strategic and operational levels. The lead agency concept can be adapted to achieve this goal.

6. Military campaign planning principals and techniques can make a substantial contribution towards achieving more effective counterdrug operations. Campaign planning can assist individual agencies and interagency endeavors alike in more efficiently using the resources available.

7. The U.S. Army can make a major contribution through educating and assisting interested drug law enforcement agencies in the campaign planning methodology.

Major Assumptions

1. The United States will experience a serious drug abuse problem for the next decade and longer.

2. The American people will continue to demand actions to eliminate or greatly reduce the drug problem.

3. Efforts will continue at the federal, state, and local levels to improve counterdrug policies, techniques and procedures.

4. Planning, programming and budgeting for coordinated and sustained counterdrug operations is seldom accomplished in the

interagency arena. Campaign planning techniques may provide a means of permitting long-term joint operations.

Main Limitations

Timely and reliable data on drug consumption and drug trafficking operations is sometimes difficult to obtain.

Scope of the Study/Study Objectives.

1. Provide a basic understanding of the drug problem

2. Provide a detailed description of the federal drug law enforcement system both for U.S. domestic operations and U.S. counterdrug activities in foreign lands.

3. Show how military planning procedures can be adapted to counterdrug operations.

Basic Approach/Why the Study?

1. The study seeks to explain why the drug problem is such an important issue to resolve and to show the reader how the federal government has organized its forces to attack the supply side of the problem. It goes on to show how military planning methods can benefit the drug law enforcement effort.

2. The study was needed because no single document previously existed which clearly and concisely:

a. Described the magnitude of the problem
b. Explained the existing supply-reduction infrastructure
c. Showed the lack of planning at the operational level and the need for tying strategy to tactics in a more efficient manner, and
d. Gave instruction and example of how to do drug campaign planning.

STUDY IMPACT

1. Study was adopted for use at the National Interagency Counternarcotics Institute; the Naval War College; The U.S. Army Command & General Staff College; the U.S. Military Academy at West Point, NY; Operation Alliance; Operation North Star; the U.S. Army Military Police School and others. Many letters of praise by senior U.S. Army leaders and several Unified Commanders. 5000 copies have been distributed and another 2000 are on order.

2. The study has already resulted in new planning procedures by various drug law enforcement coordinating bodies. Use of the principals set forth should result in a saving and more efficient use of resources.

STUDY SPONSOR

Strategic Studies Institute, U.S. Army War College

Authors

Murl D. Munger and William W. Mendel, U.S. Army War College

DTIC ACC (submitted; TBA)

COMMENTS AND QUESTIONS

Director, Strategic Studies Institute, U.S. Army War College,
Carlisle Barracks, PA 17013
POC: Murl D. Munger
AUTOVON: 242-3911

INTENTIONALLY LEFT BLANK

CHEMICAL AND CONVENTIONAL CASUALTY ESTIMATION FOR COMMANDERS, DECISION SUPPORT SYSTEM (DSS) PACKAGE STUDY GIST

THE PRINCIPAL FINDINGS

(1) The decision support system (DSS) developed in this study gives the user the ability to quickly estimate battle casualties from chemical and conventional warfare. It is a mathematical model for estimating US Army casualties in a mid-to-high intensity wars in a desert or European environment.

(2) The DSS provides commanders with a stand-alone, user friendly, PC operated software for estimating chemical and conventional warfare casualties. It supports quick turnaround analyses at the corps, division, and regimental levels. The DSS is a tool for commanders and G1/S1 staff officers.

(3) Based on the commander's predetermined set of circumstances, the DSS estimates a range of casualties, including a median value. The model allows decision makers to factor in their assessment of unit readiness, mission, current situation, and expected battle outcome.

THE MAIN ASSUMPTIONS

(1) Using the scenario and results of the Chemical and Conventional Casualty Estimation by Circumstance study, dated Oct 90; decision makers will factor into the model those circumstances that are unique to their specific units (e.g., unit readiness, mission, etc.).

(2) ODCSA analyzed over 200 battles, acquired from the USA Concepts Analysis Agency (CAA) Historical Battles Database, and extracted 32 desert and 35 Northern European battles which provided the basis for calculating conventional casualties. In addition, Ballistic Research Laboratory's (BRL) Army Unit Resilliency Analysis (AURA) results provided the basis for calculating chemical casualties. The net sum of these casualty calculating mechanisms are sufficient to approximate the expected casualty rates in modern warfare.

THE PRINCIPAL LIMITATIONS

(1) The resulting data from the model represents a "range" of possible casualty outcomes. The model's capability to make point estimates is only as good as the commander's ability to assess unit readiness, mission, current situation, and expected battle outcome.

(2) The model will not decompose results into types of casualties (e.g., KIA, WIA, D-NBI, or MIA), by MOS, or by weapon system.

THE SCOPE OF THE STUDY

(1) Develop a mathematical, computer DSS to support quick turnaround analyses for estimating casualties during Command Post and Field Training Exercises (CPX/FTX).

(2) Provide an automated DSS for estimating a range of possible casualties from extremely low to extremely high, given a selective set of circumstances; using purely historical data and BRL's AURA results.

THE STUDY OBJECTIVES To develop an automated DSS that would estimate the number of US Army casualties in a desert or European environment that decision makers may use as a tool to approximate their expected losses.

BASIC APPROACH

(1) Building on the results of the Chemical and Conventional Casualty Estimation by Circumstance study, develop the automated DSS that allows decision makers to input battlefield environment variables, battle duration, and unit posture. The DSS will calculate casualty estimates

based on these factors.

(2) Automate casualty assessment using Nantucket's Clipper programming software to calculate chemical and conventional casualties.

REASONS FOR PERFORMING STUDY Requested by HQ III Corps in Dec 90, the DSS was designed as a theater-specific casualty prediction model that supports quick turnaround analyses for estimating casualties during Command Post and Field Training Exercises (CPX/FTX).

STUDY IMPACT III Corps initially used the DSS as a decision tool during a series of CPXs/FTXs from Jan-Apr 91. The favorable feedback from III Corps resulted in Army-wide requests for the DSS package; including the 1st Cavalry Division which was deployed to Southwest Asia at the time of the report. The model provided major commands with a responsive decision tool for estimating casualties.

STUDY SPONSOR

Commander
III Corps and Ft Hood
ATTN: AFZF (BG P.T. Weyrauch)
AFZF-GA (MAJ Harriman)
Ft Hood, TX 76544-5000

PERFORMING ORGANIZATION AND PRINCIPAL AUTHORS

Headquarters TRADOC
Deputy Chief of Staff for Analysis
ATAN-AA
Ft Monroe, VA 23651-5143
Principal Authors: MAJ Samuel R. Golden, Mr. Richard T. Maruyama, Mr. Robert L. Ford, CPT(P) William N. Prokopyk, CPT(P) Paul M. Crawford, and Mr. Morris F. Hunter

DTIC ACCESSION NUMBER:

M200037	Chemical and Conventional Casualty Estimation for Commanders, Decision Support System. Version 1.0 (Computer Diskette).
B155864	Same as Above. User's Guide.
B155806	Same as Above. Executive Summary.

COMMENTS AND QUESTIONS MAY BE SENT TO:

Headquarters TRADOC
Deputy Chief of Staff for Analysis
ATTN: ATAN-AA (CPT(P) Bern Ruiz)
Ft Monroe, VA 23651-5143
AV 680-5844

START AND COMPLETION DATES OF STUDY:

Dec 90 - May 91

COMPARISON OF THE JANUS(A) COMBAT MODEL TO NATIONAL TRAINING CENTER (NTC) BATTLE DATA

STUDY GIST

THE PRINCIPAL FINDINGS

(1) NTC MILES field exercise data can be qualified into a Janus(A) combat model scenario that accurately represents the task organization, concept, and synchronization of the actual NTC mission. Qualification of NTC data can only be accurately qualified by personnel experienced in OPFOR/US doctrine. Current qualification procedures require automation which will greatly speed the process.

(2) Statistically significant attrition differences occured between a similar NTC MILES and Janus(A) scenario, with Janus(A) attrition being much larger than actual NTC attrition. The following reasons contribute to this difference. The AMSAA "real weapon" probability of hit (PH) data used in Janus(A) appear more optimistic than NTC MILES PH performance. Also, Janus(A) does not currently model NTC MILES occurrences of: direct fire fratricide, direct fire target overkill, or direct fire engagements beyond maximum effective range.

(3) Enhancements to the Janus(A) combat model that will improve the qualification and the accurate representation of NTC missions include: a multi-tasking environment, graphical editors, and modeling of crew performance degradations.

(4) Improvements in the existing NTC data collection/storage process and critical additional data will increase the accuracy and reduce the time of qualifying NTC missions in Janus(A).

THE MAIN ASSUMPTIONS

(1) The NTC scenario used in this study provides an representation of NTC MILES field exercise results.

(2) The NTC data collected and stored from this NTC MILES field exercise is sufficient to process this combat simulation as a Janus(A) combat model scenario.

THE PRINCIPAL LIMITATIONS

(1) The study data analysis is limited by sample size. One actual NTC laser mission was qualified for the study's scenario. This one set of data is compared to eight Janus(A) scenario runs of that scenario.

(2) Furhter, this study highlighted key limitations and inaccuracies in NTC data collection caused by instrumentation and software constraints. These limitations and inaccuracies have to be fully understood in order to accurately process NTC data into a Janus(A) scenario. Uninstrumented players and missing/false repeated MILES events are two examples.

THE SCOPE OF THE STUDY

(1) Provides a methodology for comparisons of combat result between two different types of combat simulation.

(2) Executes this comparison methodology on an illustrative NTC MILES defensive mission.

(3) Highlights modeling inconsistencies between NTC MILES field exercises and the Janus(A) combat model.

(3) Provides recommendations to improve NTC data collection and the Janus(A) combat model to better process NTC field exercises into Janus(A) scenarios.

THE STUDY OBJECTIVES

(1) Enhance and document the best possible NTC data qualification methodology for Janus(A) version 1.51. "Qualification" is defined as the processing of archived NTC data in order to run an NTC mission in the Janus(A) combat model.

(2) Conduct Janus(A) runs with a qualified NTC scenario and then conduct available data comparisons between the actual NTC laser battle and Janus(A) scenario runs.

(3) Note limitations in NTC data and suggest improvements in NTC data collection procedures to facilitate the accuracy and speed of qualifying NTC missions in Janus(A).

(4) Note limitations and suggest improvements in the Janus(A) combat model to increase its analytical and training value.

(5) Highlight modeling inconsistencies between the NTC and Janus(A) combat simulations.

BASIC APPROACH

The approach applies recently developed analysis tools on an NTC MILES field exercise. In a multi-step process, the qualification methodology first assesses the NTC mission with archived video and written recordings contained in the ARI-POM archives. The procedure then retrieves and modifies archived digital data and places it into Janus(A) scenario input files. Using an analysis of unit system level activities within the model, the process reconstitutes unit mission scenarios. Finally, the methodology modifies the Janus(A) database to reflect the NTC environment and mission conditions. Janus(A) results on an illustrative blue force (BLUEFOR) task force defense mission provide direct fire and attrition data for comparative analysis. This comparison used summary, temporal and spatial statistical techniques.

REASONS FOR PERFORMING THE STUDY

This study was conducted to address the two significant DOD problems described below. An extensive literature search was conducted and no similar study had been performed.

(1) The 1987 GAO report, *DOD SIMULATIONS Improved Assessment Procedures Would Increase the Credibility of Results*, concludes that the principle weakness of DOD simulation credibility centers on the lack of validation of simulation results. This study supports the validation of both the Janus(A) combat model and National Training Center (NTC) MILES field exercises by comparing scenario results of these two levels of combat simulation.

(2) The 1986 GAO report, *ARMY TRAINING National Training Center's Potential Has Not Been Realized*, concludes that the Army has not adequately developed a system to use archived NTC data to identify and solve recurring training problems. This study looks at better ways to use archived NTC data for training improvements.

STUDY IMPACT

(1) This study provides the Army community with a methodology to create libraries of actual NTC scenarios within the Janus(A) combat model. Implementing this methodology will allow both commanders and analysts to use archived NTC MILES exercise data (collected at a cost of over $4M per rotation). Commanders could use these scenarios as a tool to help highlight "what if" training and doctrine issues, and solve recurring NTC training problems before and after a unit's NTC rotation. Analysts and researchers can use this tool to investigate combat development, doctrine and performance concerns.

(2) This study provides insight into simulation validation, which is the major GAO-identified weakness in simulation accreditation. This is accomplished by comparing scenario execution in two different levels of combat simulation: NTC MILES field exercises and the Janus(A) combat model.

(3) Finally, this study establishes the cornerstone of our future analysis efforts which is directly focused on improving the credibility of these simulations.

STUDY SPONSOR

HQDA
ATTN: SAUS-OR (Mr. Walter W. Hollis)
Room 2E660, The Pentagon
Washington, D.C. 20310-0102

PERFORMING ORGANIZATION AND PRINCIPAL AUTHOR

U.S. Army TRADOC Analysis Command-Monterey
P.O. Box 8692, Naval Postgraduate School
Monterey, CA 93943-0692
Principal author: CPT David A. Dryer

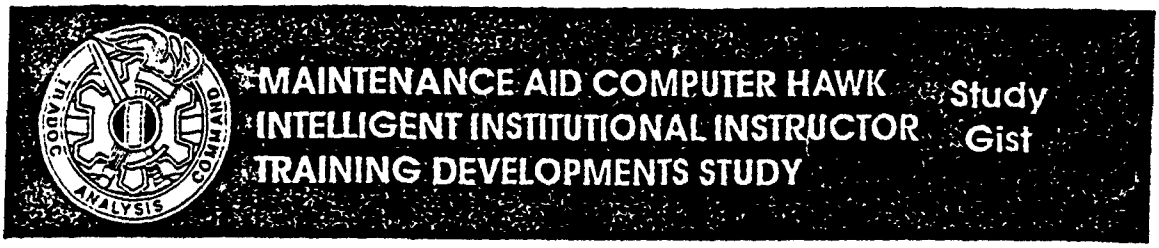
DTIC ACCESSION NUMBER: DA318608

COMMENTS AND QUESTIONS MAY BE SENT TO:

U.S. Army TRADOC Analysis Command-Monterey
ATTN: ATRC-RDM (CPT Dryer)
P.O. Box 8692, Naval Postgraduate School
Monterey, CA 93943-0692 DSN 878-3086

START AND COMPLETION DATES OF STUDY:

Apr 88 - Jun 91



THE REASON FOR PERFORMING THE STUDY was to compare the training effectiveness of an intelligent tutoring system (ITS) called MACH III to the traditional paper-based method of instruction for radar maintenance training. The MACH III is designed to help MOS 24C students conceptualize radar signal loops-within-loops and help them to apply this knowledge to obtain faster, more efficient troubleshooting solutions; however, this claim had not been independently tested. It became necessary to quantify the training benefits/drawbacks of incorporating the MACH III into the current MOS 24C program of instruction (POI) in order to justify future expenditures to develop additional software and perhaps to expand the use of the MACH III concept to other MOS training. The opportunity to evaluate an application of artificial intelligence within an Army training device had not occurred before MACH III was developed. The development of MACH III served as a proof-of-concept exercise which has implications for future use of ITS in Army training.

THE PRINCIPAL RESULTS were as follows:

The performance testing showed that students performed similarly regardless of the instructional method used.

The MACH III method of instruction produced a more consistent group performance than the paper-based method did.

The MACH III method of instruction provided more tasks in the time available for troubleshooting and a greater range of tasks difficulty than the paper-based method.

The MACH III method of instruction resulted in faster troubleshooting solutions on the actual transmitter than the paper-based method.

The MACH III software did not always represent the complete fault isolation procedures that would be used on the actual HPIR.

The structure provided by an ITS can lessen the differences between instructors and the inconsistencies of an individual instructor from one day to the next.

While an ITS may provide a more consistent product and may eliminate low scoring performances, the risk exists that the use of an ITS may eliminate some high scoring performances as well.

An ITS can free up the instructor to do what he does best; while the ITS provides the basic structure of a training exercise, the instructor can focus on leading group discussions, answering in-depth questions, and directing hands-on training on actual equipment.

An ITS can provide the opportunity to train more tasks than before, and it also can provide a medium for performing tasks not ordinarily performed on actual equipment because of a risk to expensive components, difficult fault insertion, or time constraints.

The greater task coverage, repetition, and structure afforded by ITS can result in faster troubleshooting solutions on actual equipment than with traditional methods.

THE MAIN ASSUMPTION was that the study sample was representative of all MOS 24C students.

THE MAIN LIMITATION was maintenance record data were unavailable for analysis.

THE SCOPE OF THE STUDY focused on the training effectiveness of two methods of instruction for the transmitter and receiver blocks of the MOS 24C HAWK Firing Section Mechanic POI. The study was designed to compare the training effectiveness of two POIs with the same conference content but different practical content. One POI contained conference (lecture), hands-on training on the HPIR itself, and paper-based troubleshooting drills, and the other POI contained conference, hands-on training on the HPIR, and troubleshooting drills using MACH III. Students who were assigned to the POI using paper-based troubleshooting drills became the control group for the study, while students who were assigned to the POI using the MACH III were the experimental group. Basically, the question to be answered in this study was which method of instruction provided a training effective and efficient supplement to practical radar training—troubleshooting on paper or troubleshooting on MACH III.

THE STUDY OBJECTIVES were to determine the training benefits/drawbacks of incorporating the MACH III into the MOS 24C POI and to determine how incorporating MACH III training into the MOS 24C POI will impact actual maintenance of the radars used in training.

THE BASIC APPROACH was to assign the students to one of two groups: one group received conference, hands-on radar training, and MACH III, and the other group received conference, hands-on training, and paper-based troubleshooting. The study team administered written, practical, and oral essay examinations, collected time on task data, administered opinion surveys, and collected data on the downtime of training radars and MACH III student stations.

THE STUDY SPONSOR was the Deputy Chief of Staff for Training, HQ Training and Doctrine Command. The U. S. Army Air Defense Artillery School was the proponent for the study.

THE STUDY AGENCY was U. S. Army TRADOC Analysis Command, ATRC-WGA, White Sands Missile Range, NM 88002-5502. The POCs are Ms. Sylvia C. Acchione-Noel and Dr. Dale M. Dannhaus, AUTOVON 258-4645/5915.

THE STUDY IMPACT. Specifically, this study determined the training benefits/drawbacks of incorporating the MACH III into MOS 24C HAWK Firing Section Mechanic students AIT. More importantly, the study served as a proof-of-concept exercise towards the Army's future use of intelligent tutoring systems (ITS) in Army training. This study led to conclusions which generally apply to the use of intelligent tutoring systems that are being proliferated across Army training. In the future, ITS can free up the instructor to do what he/she does best; while the ITS provides the basic structure of a training exercise, the instructor can focus on leading group discussions, answering indepth questions, and directing hands-on training on actual equipment. An ITS can provide the opportunity to train more tasks than before, and it also can provide a medium for performing tasks not ordinarily performed on actual equipment because of a risk to expensive components, difficult fault insertion, or time constraints. This study provided insights in to how the Army should train using ITS especially in a resource constrained environment.

CAA — Concepts Analysis Agency, United States Army	POMCUS SITING ALTERNATIVES (POMCUSITE) STUDY (U)	STUDY SUMMARY CAA-SR-91-8

THE PRINCIPAL FINDINGS of the work reported herein are as follows:

(1) Redistribution of POMCUS assets applying the USAREUR-selected distribution priorities significantly improved the fill for high-priority units. Redistribution of the TAEDP distributions which are over authorizations yielded potential average improvements of 4.1 percent in fiscal year (FY) 90 and 7.9 percent in FY 96.

(2) Model-generated unit flag siting plans significantly decreased the average unit distance from storage area to unit general defense position (GDP) while increasing project integrity (fewer storage sites per project).

(3) The model-generated optimized equipment transfer lists resulted in significantly fewer equipment item moves than if entire unit sets had been transferred intersite.

THE MAIN ASSUMPTIONS of this work are that the current concept of operations for the forward repositioning of equipment will continue, and that the size of POMCUS will decrease based on budgetary and political decisions.

THE PRINCIPAL LIMITATION of the model is that it does not automatically provide for trade-off considerations among component modules. The developed decision support system is implemented as three sequentially processed modules which collectively develop improved POMCUS equipment management plans to support military objectives. The modular sequence produces: (1) prioritized equipment distribution; (2) improved unit storage siting; and (3) efficient repositioning of stored equipment. This sequential modular approach efficiently develops a best (preferred) military operational result for each module. Each modular result then modifies and constrains subsequent processing. While highly computationally efficient, this sequential approach does not automatically provide for trade-off considerations among modules. In practice, the user may incorporate such trade-offs by selective iteration over the component modules.

THE SCOPE OF THE STUDY was based on a Europe-only scenario during the 1990-1997 timeframe.

THE STUDY OBJECTIVES were to:

(1) Perform an analysis of the siting requirements for current and projected POMCUS packages, using optimization techniques to allocate packages to available sites, using the objective criteria of decreasing the distances from unit set storage sites to respective unit GDPs, siting unit sets belonging to unique projects at fewer storage sites, and reducing the cost of relocating unit sets to alternate sites in terms of short ton (STON)-kilometers. The analysis will develop alternative siting plans.

(2) Develop an automated methodology (model) which will enable the USAREUR ODCSLOG staff planners to analyze alternative POMCUS unit siting alternatives. Implement this model as a micro-based analytic tool which will permit planners to increase the proximity of unit equipment sets to the projected unit GDPs.

(3) Demonstrate use of the model by generating reports displaying the relationship of unit equipment siting to projected unit destination using both current plans and the model-generated siting alternatives.

THE BASIC APPROACHES used in this study were to:

(1) Identify the major model functions required to accomplish the study objectives.

(2) Identify the information and automated input/output requirements for each of the major model functions (modules).

(3) Develop each of the modules and the required user interfaces.

(4) Test each module independently prior to performing an integrated system test.

(5) Document the study, the model, and the study results.

THE REASONS FOR PERFORMING THE STUDY were to develop a decision support tool (model) to assist in POMCUS (prepositioning of materiel configured to unit sets) program management; to demonstrate the use of the model by redistributing POMCUS assets using a different fill methodology, developing alternative unit flag siting plans responsive to changes in prioritization, and generating optimized equipment transfer lists to accomplish the military objectives; and to document the model and results of analyses conducted using that model.

THE IMPACT OF THIS STUDY-developed decision support system is that it provides POMCUS program managers with a convenient, efficient, and effective means to develop alternative plans for improving POMCUS equipment redistribution, unit storage siting, and intersite equipment movement. The resulting plans embody cost efficient accomplishment of multiple USAREUR military objectives.

THE STUDY SPONSOR was the US Army Europe (USAREUR) Deputy Chief of Staff for Logistics (DCSLOG), War Reserve Office, who established the study objectives and monitored study activities.

THE PERFORMING ORGANIZATION AND PRINCIPAL AUTHORS of this study were: US Army Concepts Analysis Agency (CAA), Force Systems Directorate, 8120 Woodmont Avenue Bethesda, MD 20814-2797; Mr. Theodore Ahrens

THE DTIC ACCESSION NUMBER for this study is: DA332023

COMMENTS AND QUESTIONS may be sent to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-FS, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.

START AND COMPLETION DATES of this study were: Nov 89 - Sep 91.

ABSTRACTS OF THE DR. WILBUR B. PAYNE MEMORIAL AWARD FOR EXCELLENCE IN ANALYSIS 1991 PAPERS

The Dr. Wilbur B. Payne Memorial Awards for Excellence in Analysis

1991

The Payne Award, Group Category, was presented for the work covered by *Forward Area Air Defense System (FAADS) Line-of-Sight Rear (LOS-R) and Line-of-Sight Forward Heavy (LOS-F-H) Model-Test-Model (M-T-M) Study* by Charles Miller, Jacqueline M. Weddington, and Lounell D. Southard, TRAC-WSMR-TR-91-025, August 1991 (SECRET). In addition to the principal authors of the paper, the following also received the Payne Award for their contributions to the work represented by the paper: Thomas Cavin, Douglas Mackey, and MAJ William Shorthill, US Army TRADOC Analysis Command-White Sands Missile Range; Harry Pasini, Jr., Operational Evaluation Command; and MAJ Larry Dubois, TEXCOM Experimentation Center.

The study was designed to determine if resources can be saved by not performing an on-the-ground baseline test, but rather by adequately addressing the baseline issues through simulation. An ancillary component of the study was to determine if sound representative scenarios for field testing can be developed by using the JANUS-T model.

The main objectives of the study were to:

calibrate the CASTFOREM combat model with the AVENGER (now included under the designation LOS-R) and the LOS-F-H force-on-force test results;

calibrate the JANUS-T and CASTFOREM combat simulation models;

demonstrate the applicability of simulation for planning force-on-force operational testing; and

provide a basis for comparing LOS-F-H to VULCAN/MANPADS (Man-Portable Air Defense System) performance to support the LOS-F-H evaluation.

The scope of the study was to calibrate (that is, make adjustments to input data or model logic to obtain agreement with field tests) by comparing test (AVENGER, MANPADS, and LOS-F-H) results and model (CASTFOREM) results. Additionally, modeled VULCAN/MANPADS results were compared to the modeled LOS-F-H results.

The basic approach was to model 13 IOTE (Initial Operational Test and Evaluation) AVENGER scenarios and 12 IOTE LOS-F-H scenarios conducted at Fort Hunter-Liggett. Fire unit positions, aircraft flight paths, and RED and BLUE tactics and doctrine of the

field test players were modeled in CASTFOREM with RED and BLUE performance data provided by US Army Materiel Systems Analysis Activity (AMSAA). Trend, statistical, and operational analyses were used to compare model and test results . Performance measures for LOS-F-H model results were also compared to VULCAN/MANPADS model results.

Principal results of the study are:

Calibration of model and test results can be obtained within given tolerances;

Standard model inputs need to be modified prior to replicating field tests;

Detection results are the most difficult to replicate in a simulation because of limitations of the model (e.g., limited cueing and granularity of terrain);

Limited data collection capability (e.g., altitude data) results in model-test discrepancies;

Extensive coordination among the evaluator, tester, and modeler is required to minimize model-test discrepancies; and

LOS-F-H is more effective than VULCAN/MANPADS based on model results.

The M-T-M effort was an extraordinary demonstration of analysts, modelers, evaluators, and testers working together. Considerable coordination and cooperation was required to collect the needed test and model data without jeopardizing either the test or model results. Understanding data collection procedures, system capabilities, and the modeling of those capabilities by computer algorithms was imperative for all the team members.

The innovative application of sound analytical, modeling, testing, and evaluation skills, devotion to duty, and dedication to Army research efforts by the team members represents a pioneer piece of work that directly affects Department of the Army acquisition decisions. The procedures developed are applicable to many combat simulation models, field tests, and weapons systems. The study participants are recognized for their outstanding achievements by the presentation of the Dr. Wilbur B. Payne Memorial Award for Excellence in Analysis, Group Category.

The Payne Award, Individual Category, was presented for work by Harry J. Kirejczyk, US Army Natick Research, Development and Engineering Center. Mr. Kirejczyk's paper is titled *Class 1 Prepositioned War Reserve Material Stocks*.

The quantity of combat rations required to be stockpiled worldwide to feed military personnel in case of conflict is staggering. For the Army alone, the number is 200 thousand meals at a cost of more than $700 million. Actual stockage is significantly less than requirements, because of low peacetime consumption levels and regulations which restrict actual stockage to that which can be rotated thru consumption. Rotation is a function of shelf life.

Mr. Kirejczyk developed two user friendly decisionmaker models to identify and evaluate more effective alternatives to the current Class 1 war reserve system. Primary measures of effectiveness include total annual cost and the ability to maintain and rotate readiness (that is, stockage) requirements. The models incorporate the many ration parameters, factors, constraints, and policy decisions including their interactions relative to performance objectives, such as to reduce cost or increase readiness.

The models can be used to minimize cost or maximize readiness subject to applicable constraints, identiy and validate benefits of future ration stockage concepts, evaluate alternative policies, determine optimal policies, and optimize ration stockage parameters.

The needs and benefits of an extended shelf life individual ration for stockage in Europe were identified. The benefits include:

> Peacetime cost savings of up to $75 million to maintain and rotate the total war reserve requirement for Europe; before the drawdown, that amounted to 132 million meals;
>
> Peacetime cost savings of up to $30 million to maintain and rotate the current (before the drawdown) individual meal requirement for Europe of 53 million meals; and
>
> Increased war reserve stockage or readiness levels of individual rations of up to 74 percent with no increased cost or consumption requirements.

The approach used by Mr. Kirejczyk is general in nature and is extendable to any war reserve commodity with shelf life rotation constraints. Mr. Kirejczyk's technical expertise, dedication, and commitment to excellence have resulted in this contribution and he received the 1991 Dr. Wilbur B. Payne Memorial Award for Excellence in Analysis, Individual Category for this significant contribution.

A special Payne Award was made this year by Mr. Walter W. Hollis, Deputy Under Secretary of the Army (Operations Research). Because the work for which the award is presented, in support of Operations DESERT SHIELD and DESERT STORM, is still highly classified, it cannot be reviewed in detail here. A general summary is presented.

When Iraqi forces invaded Kuwait in August 1990, US Army Concepts Analysis Agency organized a special team of analysts to carry out very high priority efforts to analyze likely courses of action by Iraq and alternative responses by US and coalition forces. A number of theater campaigns to defend Saudi Arabia and restore pre-invasion Kuwait borders were developed and analyzed.

COL Arthur E. Parker, III, LTCs Linda L. Hampton, James O. Kievit and Charles D. Shelton, MAJORs Jeffery A. Appleget, Daniel J. Russell and Dee Wells, CAPTAINs David B. Knudson and Michael Rizzio, and Messrs. Ronald B. Bonniwell, Hugh W. Jones, Stanley H. Miller, Neal W. Siegel, R. Glenn Stockton, and John M. Tucker, all of the Concepts Analysis Agency, collectively played a key role in the successful outcome of the DESERT STORM Campaign. The team reported directly to the Deputy Chief of Staff for Operations and Plans (DCSOPS), Headquarters, Department of the Army, and provided almost daily updates responding to the dynamic situation. Using near-real-time intelligence data and friendly force information, the team developed model inputs and performed theater analysis around the clock. During the course of DESERT SHIELD and DESERT STORM, more than 500 full-scale theater simulations were developed and analyzed. The results were briefed to the highest levels; the team ultimately prepared and presented over 100 briefings. A number of separate reports were published by the team. The DCSOPS stated, commenting on the team's performance and contribution to the war: "The analytical support you provided for Operations DESERT SHIELD and DESERT STORM has been absolutely outstanding....[Your work has been] used by the Army Staff, the Joint Staff, and our Army in Southwest Asia to prepare for war. The Army leadership used it for discussions and briefings with key military and civilian leaders, including the National Command Authority." The CAA study team is commended for the quality and timeliness of its analysis, which, from beginning to end, far surpassed any previous CAA analytic effort. For this professionalism and selfless dedication, the team is presented a special Dr. Wilbur B. Payne Memorial Award for Excellence in Analysis for support to current operations.